From waste to value: Green chemical production in mixed microbial cultures

Junicke, Helena; Flores-Alsina, Xavier; Gernaey, Krist V.

Publication date:
2018

Document Version
Peer reviewed version

From waste to value: Green chemical production in mixed microbial cultures

Helena Junicke[*]*, Xavier Flores-Alsina and Krist V. Gernaey, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Søltofts Plads, 2800 Kgs. Lyngby, Denmark*

[*]*Email: heljun@kt.dtu.dk*

Today's chemical production and energy supply strongly depend on fossil feedstocks. This is not only linked to problematic greenhouse gas emissions. The limitation of fossil resources also means there is an imminent end to traditional hydrocarbon economy and industries will need to deploy production concepts on the basis of renewable commodities[1]. Mixed culture biotechnology holds promise to become a corner stone in next generation chemical production platforms[2]. Unlike microbial pure cultures requiring sterile substrates, mixed cultures can produce valuable chemicals from low-value feedstocks and even waste streams. However, controlling the product spectrum in mixed microbial bioconversions remains a key challenge and progress in this direction is hampered since generalized process models are not yet encompassing the formation of higher value products[3].

Here we present general extensions to state-of-the-art process models that allow an improved implementation of resource and energy recovery in the frame of mixed microbial conversions. Taking the example of butanol, an energy-rich biofuel with properties similar to gasoline, we demonstrate how continuous production strategies can be established. These strategies rest on ecological selection principles aimed to direct the microbial population structure towards a desired product space[4]. We anticipate our model framework to be the starting point for intensified research at the intersection of environmental and industrial biotechnology with a mission to leverage the full potential of circular economy.

Literature

*1. Mansouri, S. S., Udugama, I. A., Cignitti, S., Mitic, A., **Flores-Alsina, X.** and **Gernaey, K. V.**: Resource recovery from bio-based production processes: a future necessity?, 2017, Current opinion in chemical engineering, 18, 1-9.*

2. Kleerebezem, R. and van Loosdrecht, M. C. M.: Mixed culture biotechnology for bioenergy production, 2007, Current opinion in biotechnology, 18(3), 207-212.

3. Batstone et al.: The IWA anaerobic digestion model no 1 (ADM1), 2002, Water science and technology, 45(10), 65-73.

*4. **Junicke, H.**, van Loosdrecht, M. C. M., & Kleerebezem, R.: Kinetic and thermodynamic control of butyrate conversion in non-defined methanogenic communities, 2016, Applied microbiology and biotechnology, 100(2), 915-925.*

☑ Oral contribution

☐ Poster contribution

Stream:

☐ Industrial-scale bioprocess operation

☐ Process analytical technologies (PAT) for understanding bioprocess scale up

☐ Bioprocess development and intensification

☐ Single use processes

☑ Scaling of bioprocesses for the circular economy

☐ Micro sensors for bioprocesses

Upload your abstract at https://www.vlb-berlin.org/en/bioproscale2018-callforpapers